THE DESIRE FOR FOOD IN MAN

By MINNA C. DENTON
OHIO STATE UNIVERSITY

IN these days there is hardly a more commonly accepted principle of human conduct than the tendency to supplant inherited instincts by experience based upon organized knowledge; nor will the teachings of unorganized knowledge prove an acceptable substitute. Unaided mother-love has brought up most of the babies reared to adult stature since the dawn of creation, yet it must confess that modern methods in medicine have bettered its instructions. No longer is it possible for the singer, the engineer, the nurse, the teacher, to make headway professionally without scientific training; and now the cook, the policeman, the saleswoman and the charity worker are beginning to follow suit.

Moreover, in regard to inherited instincts, it has to be admitted that they are sometimes altogether lacking upon most important occasions, or even fundamentally wrong. It is well known that though many animals, thrown into the water for the first time, can save their lives by swimming, the inexperienced human is usually unable to do so. The instinct for scratching an irritated skin is almost ineradicable, yet ordinarily mischievous and often dangerous. The universal liking for so powerful a poison as alcohol, so easily developed by all races of men, has sometimes been cited to disprove any possible theory of organic evolution. Such instances as these may easily be multiplied.

How does this apply to that absolutely universal, most important, and least considered (from the scientific standpoint) of all human performances, the every-day business of eating?

It is perhaps a self-evident proposition, that the human body is, physiologically speaking, a machine, *i. e.*, a complicated system of more or less perfectly coordinated mechanisms, for which foods serve the double purpose of supplying structural material and also fuel which keeps the engines running. It is a deduction which few would care to deny, that any machine will run better and last longer if built of proper materials suitably repaired, and fed with the proper kind of fuel, in amounts suited to the kind of work it has to do. Yet the universal criterion used by the builder, repairer and stoker of this machine is the desire to eat, dignified by some such name as "the normal healthy appetite," "natural instinct for food." And meantime, the tendency of physicians to use "regulation of the diet" rather than medicine, as

a means of combating a long and diversified list of human ills, seems to be constantly and most disturbingly on the increase.

It is to be observed that there is no immunity from any of these ills for the multitude who (explicitly or tacitly) maintain that eating should be entirely an esthetic performance, guided solely by refined and restrained sense gratification and adapted to encourage social intercourse; a performance, then, which can have as little concern with calories and protein, as has the music-lover's enjoyment of a beautifully taken high G, with a consideration of the wave-lengths of the vibrations which produced it. This attitude toward scientific nutrition has, needless to say, as little efficacy in warding off the physical ills resulting from dietetic errors, as has the behavior of the traditional ostrich toward the danger by which it is confronted.

Let us undertake an analysis of the motives involved in the desire for food, as they commonly operate among the various classes of people of our own day and country.

1. Hunger. Beginning with the more fundamental physiological motives, we find that recent investigations[1] seem to demonstrate conclusively a fact which most of us will be inclined to concede at once, or at least after a little reflection, viz., that hunger and appetite are distinctly different motives. Hunger is to be defined as an unpleasant sensation, referred by most people to the pit of the stomach or closely adjacent regions, not caused by the sight or thought of food, but by a certain type of contractions of the stomach muscles which begin as soon as the stomach has been emptied, in normal individuals, and which continue until food is taken. The degree of hunger sensation or pang to which (presumably) these muscular contractions give rise, varies in different individuals, and also, of course, in the same individual at different times. Both the muscular performance and the sensation occur intermittently at first, or in periods of varying intensity, but at length these periods become continuous if no food is taken. In prolonged starvation or undernutrition, however, it seems that the hunger *sensation* (though not the contractions) gradually becomes weakened. Hunger pangs and contractions are almost instantly stopped by the entrance of food or palatable substances into the stomach, or even by fused taste and smell sensations unaccompanied by the swallowing of food. A few spoonfuls of hot soup, though they may contribute little or no nourishment to the body, go far toward alleviating hunger pangs for the moment; even a drink of water sometimes helps; and this would be true even though the liquid were not swallowed, as was proved in case of Mr. V———, Professor Carlson's

[1] Cannon and Washburne, "An Explanation of Hunger," *American Journal of Physiology*, Vol. XXIX., p. 441. Carlson, "Contributions to Physiology of the Stomach," *American Journal of Physiology*, Vols. XXXI.–XXXIX. incl., also "Control of Hunger in Health and Disease," University of Chicago Press.

man with occluded esophagus, who had to be fed with stomach tube. Such facts perhaps indicate to us the biological necessity for the co-operation of appetite with hunger.

2. Appetite is sometimes regarded as a fundamental inherited reaction, and sometimes as being wholly the product of educatlon, *i. e.*, of the individual's experiences with foods. In contradistinction to hunger, appetite is a pleasant sensation, and is invariably associated with the taste, smell, sight or memory of palatable food. It is dependent upon, or coincident with, changes not in the muscular walls, but in the lining membrane of the mouth and stomach. The familiar "watering of the mouth" or psychic secretion of the saliva, connected with the appearance and eating of food which is enjoyed, is a good illustration of these appetite phenomena; and exactly the same thing is happening at the same moment in the stomach, though the individual is not, of course, subjectively aware of this fact.

Here, then, are two great motives having altogether different physiological basis and action (*i. e.*, concerned with different tissues of the body), which ordinarily act together in bringing about and maintaining the desire to eat, until the amount of food taken shall have become adequate for sustenance.

The hunger motive, it seems, is extraordinarily independent of environmental and educative influences, except for certain habitual inhibitions. It can by certain means be caused to disappear instantly, but can not readily and immediately be caused to appear or increase. The strength of its contractions and pangs is, however, influenced by physical vigor and rate of metabolic activity. Moderate muscular work or exposure to cool air augments metabolism and at the same time increases hunger. The young animal, who is metabolizing (*e. g.*, burning food as body fuel) more rapidly and therefore uses more food in proportion to its size than does the older one, also feels more keenly the hunger pang. Again, one may be much more hungry coming home at midnight after the theater (say five hours after the conclusion of the evening meal) than he is before breakfast the next morning (say twelve hours after the conclusion of the last meal); presumably because, in the latter case, metabolic activity is not yet in full swing for the day, and so the hunger contractions can not attain their maximum. And yet, pleasurable appetite sensations connected with the anticipation and appearance of a good breakfast, may lead to the taking of a hearty meal, even though the individual on arising was not aware of any special hunger pain or discomfort.

Not all food materials, however, are valuable to the body in proportion to the appeal which they make to the appetite. For example: the flavor substances in foods which stimulate the olfactory and gustatory nerves and thus give rise to appetite, are not ordinarily the sub-

stances upon which the body depends for its fuel, nor for the great bulk of its building materials. These latter materials—proteins, fats or oils, and carbohydrates (*i. e.*, sugars and starches), when chemically pure, have little or no taste or smell. (Sugars and various mineral salts are of course exceptions to this statement.) But so long as flavor bodies accompany nutritive substances, as is the case in most of the animal and vegetable tissues which man has appropriated for his food, the facts just stated are without much practical significance. When these tissues have undergone manipulation which divorces flavor bodies from nutritive substances, the case is quite different. For instance, in the use of boiled meat, appetite leads us to prefer the broth, which contains most of the flavor bodies (except those which may have escaped into the air with the steam), but which has practically no nutritive value, unless quite greasy; and to reject the tasteless meat, which contains 96 per cent. of the protein; very likely we also skim the soup to remove most of the fat, which is a highly concentrated form of fuel.

The preference for thin and crisp rather than greasy bacon is another illustration of the same thing. In a recent experiment it was found that of the 129 calories which represented the fuel value of a very thin 20 gram (three fourths ounce) slice, only 9 calories remained when the slice was sent to the table; 120 calories being represented by the fat which "fried out" into the pan. In this case a considerable amount of flavor body also goes into the fat, yet most persons would not consider eating it unless it has been skilfully blended with large quantities of other foods; whereas the scrap of skeleton tissue which has lost 93 per cent. of its food value is a dainty morsel.

Many more illustrations might be given to show the great and often inordinate changes in food value of our dietaries, due to some special, sometimes even erratic demand for what the individual has been led to consider a satisfactory flavor or an agreeable texture. These demands are apt to be particularly conspicuous and variable with individuals who are sedentary workers of the middle and upper classes, who live mostly in stagnant indoor air, whose muscular tone is usually low, with relatively feeble hunger contractions. For their appetite sensations, through the development of keen discrimination made possible by the wide choice of foods now offered, even to those of very moderate means, may be exceedingly acute, though their actual food requirement is relatively low.

Let us enumerate several instances of the lack of correspondence between popular demand and actual food value. The sauce made from dried fruits is usually much higher in fuel and even in protein than are the fresh fruits, but the latter are commonly preferred for their more delicate flavor; whether they have any further advantages over the dried fruits (possibly in the presence of the still mysterious

vitamines, or substances of kindred importance, destroyed by heat and drying?) is another matter. Similarly, dried beans and peas as ordinarily cooked will have from two to three times the food value of young green ones. In a general way the same thing is true of most vegetable foods and of many meats. In the case of meats, texture is considered to be of equal importance with flavor, or sometimes of greater importance—as when tenderloin is preferred to the higher-flavored round steak. Yet the tougher cuts of meat are quite as nutritious as the higher-priced ones; and, it may be remarked in passing, can be cooked tender with the development of good flavor and without losing their nutritive value. Price is a rough index of demand; oysters at 50 cents a quart, which is about $2.25 for one thousand calories, or 56 cents for one ounce of protein, are very likely to be preferred to boneless salt codfish at 10 cents a pound, which is 20 cents per thousand calories or 2½ cents for one ounce of protein. Or grapefruit (at 10 cents for the pound size), costing 60 cents per thousand calories, are often selected rather than apples (at 30 cents a peck), which yield a thousand calories for 12 cents. There may be no reason whatever for reversing the choice in either instance, but the justification sometimes urged by the extravagant housewife, that she must have "the best" in order properly to nourish her family, is likely to be without foundation; unless a question of sanitation or digestibility may be involved, as is occasionally the case.

Besides the fact that not all food materials are valuable to the body in proportion to the appeal which they make to the appetite, we must consider the great and often irrational variations to which this faculty is subject. No other bodily sensibility, perhaps, is so easily influenced by habits and customs and conventions, by personal idiosyncrasy and prejudice, by connotating circumstances, by suggestion of every sort, by the emotional complexion of the momentary mood; none, as a rule, so highly susceptible of education. Racial, sectional, religious, social, family, individual experiences—they all have a vote in determining my ideas of what I should have to eat. So, too, does the historical era, the geographical area, in which I live. The skilfulness of my cook may have the largest "say" of all; if she does not prepare vegetables so that they are appetizing, I shall probably eat more meat, bread or fruit, though none of these is an interchangeable substitute for any other. Convenience, the cost of living, and food legislation are sometimes large factors; city life does not conduce to hearty luncheons nor even breakfasts; rich country cream on my oatmeal adds 90 calories to my breakfast over the 18-per-cent-fat-by-order-of-the health-department cream I usually get at my city boarding-house. Varying physiological conditions may act irrationally, as on the hot summer day when I take ice-cream (very likely a more concentrated food than meat) solely for its cooling effect; or when in the midst of the afternoon's

shopping I buy tea and cakes in order to get a chance to sit down for half an hour.

It is evident that many of these factors mentioned above have no conceivable relation to my bodily requirement for food, which is determined chiefly by my age and stature, the amount of muscular work I do, my general nervous and muscular tone, my exposure to cold. Digestibility of food materials and conditions which favor good digestion are essential. Yet it appears that the importance of the enjoyment of food to secure favorable psychic influences upon digestion has been considerably overestimated, since men forcing themselves for experimental purposes to live upon a diet so monotonous as to be repugnant in the extreme, digest it in normal fashion; and similar results usually obtain with forced feeding of animals.

Any condition of food materials causing them to resist digestion will reduce their availability, and in proportion to the delicacy, sensitiveness or robustness of the individual digestive mechanism. The nutritive value of bran biscuits, or of rich pastry, may be zero for some persons, though both protein and fuel values of these two articles are very high when they are fairly well digested and assimilated.

An important factor in determining the nutritive value of the dietary is due to a tendency frequently observed toward large use of "manufactured" or commercially manipulated food materials, and to elaborate blending of these materials by the cook into rich and sweet desserts and other "made dishes," which, though high in fuel value, may very likely be lacking in some of the essential body constituents. Modern processes of food manufacture frequently result in the preparation of highly concentrated food materials—sugars, starches, fats and oils, various dried preparations—whose functions, when they are taken into the human organism, alone or in artificial combinations, are specialized and limited, and whose effects upon the instincts of hunger and appetite may easily be out of all proportion to their useful functions; *e. g.*, starch is isolated from the potato, from maize, from a dozen other sources; fat is isolated from milk as butter, from pork as lard, from the olive as oil. Sugar, a carbohydrate taken from sugar cane, beet or maple, is consumed in enormous and ever-increasing quantities; a recent estimate by a federal authority places its daily consumption at one fourth of a pound per capita, for the well-to-do classes, which would cover 450 calories, or almost 20 per cent. of the total food requirement of the adult sedentary worker, and a larger proportion of the child's requirement. The obvious reason for its popularity is not that it is a concentrated form of body fuel, but that it has a pleasing effect upon the palate (very similar, it happens, to that of saccharin, which has no food value whatever); therefore it is mixed with a large number of other foods. I add "a teaspoonful or two" of

sugar and two or three tablespoonfuls of cream to my saucer of sliced peaches—to be more exact, let us say from three fourths to one ounce of sugar and two ounces of cream to five ounces of peach slices—and consider that I am eating peaches flavored with sugar and cream. It would present the facts much more exactly, from the quantitative point of view, if I should say that I am eating sugar and cream flavored with peaches. For the sugar as fuel is worth 113 calories an ounce, and the cream 108 to 144 calories (according with butter-fat content of 18 per cent. and 25 per cent., respectively; rich country cream runs higher), the peaches are worth 59 calories, or about 20 per cent. of the fuel value of the whole combination.

In cooking fruits, particularly the sour or tart flavored ones, this enormous increase of food value by sugar added for the sake of improving flavor is intensified. The cherry pie which serves six, requires for filling, let us say, five sixths of a cupful of sugar to a cupful of cherries; *i. e.,* seven and a half to eight and a half ounces of cherries worth about 170 to 190 calories, with six and two thirds ounces of sugar, worth 756 calories. The crust of this pie presents another example of combination of concentrates. One half-pint cup of flour (which will be anywhere between one fourth and one third of a pound) is combined with lard or other fat (one twelfth to one half of a pound, according to recipe used) and a small amount of water (two to four tablespoonfuls), then baked until it loses an amount of moisture equal to from 20 per cent. to 35 per cent. of its total weight. This gives the entire crust a fuel value of 700 to 2,200 calories. If we use only a moderately rich crust, and add to the filling an ounce of flour (100 calories' worth) and one of butter (218 calories' worth), we shall have a value of 430 calories for each serving of 3 ounces weight (one sixth of the entire pie). About 30 of these calories are due to the cherries, the other 400 result from the added concentrates (35 per cent. from the fat, 31 per cent. from the sugar). Had the cherries been served as fresh fruit without sugar, a liberal serving of whole cherries would be three and one half ounces, worth some 74 calories; pitted, from three to five ounces (69 to 115 calories) makes a good showing, and most persons would add half an ounce of sugar (57 calories), or some would like twice that amount. As sauce, four ounces would make a good serving; that weight represents four and one half ounces of pitted fresh fruit (103 calories' worth), which would cook down almost to three ounces and would require the addition of at least three fourths ounce of sugar (85 calories), for cooking fruit "brings out the sour taste," and adds to the demand for sweetening. The value of a four ounce serving of the sweetened sauce is then at least 196 calories.

Not many of us would care to consume two ounces of sugar (about seven lumps, or four to six leveled tablespoonfuls) for breakfast with-

out the aid of flavoring materials; yet an ounce on half a grapefruit, half an ounce on breakfast cereal, and one third ounce (one lump) in coffee, are very moderate estimates of the amount eaten by the average person. This addition of 226 calories to the breakfast would easily be doubled by persons with a sweet tooth, and the consumption of a small tablespoonful of marmalade or syrup would mean another hundred calories or more, most (or all) of which are due to sugar.

It is true that sugar is a valuable fuel food, but it is far from being able to supply all, or even a large proportion, of the food requirement. When eaten as it occurs in nature—in fruits, many vegetables, in sugar beet and cane and maple sap—it is taken in comparatively dilute form, and the plant tissue in which it occurs helps to supply small but not altogether unimportant amounts of other food substances which should accompany it, but which are cast aside as impurities in the processes of manufacture. When the sugar is taken in the "pure" or concentrated form—as, for example, in the unhygienic performance of which two school-girls with a half-pound box of candy between them are capable—it has a well-known cloying effect, so that it replaces to an undue extent other needed food principles; or if not, then it contributes to over-eating, that evil so highly prevalent (when a sound digestion permits) in the well-to-do sedentary classes. For the extra sugar adds unnecessary fuel, without being able entirely to replace protein or at all to replace mineral salts as body building material, and without being able to do the work of vitamines, organic acids or bases, and other necessary regulatory substances.

In other words, our fashions in cooking and eating are often too intensive in respect to certain preferred concentrates. No wonder the cry is raised by faddists (and by others) concerning the dangers of "denaturized foods." These statements are not, however, to be taken as an argument against the use of prepared sugars, starches and fats; but as a protest against allowing the dishes made from them to replace wholly such foods as fresh fruits and vegetables. These latter are lower in fuel value, but contain needed mineral salts, organic acids, "vitamines," etc., which are very likely lacking in the rich pudding, flaky pastry, or sweet sauce or confection.

The one factor which ordinarily predominates over others in satisfying the eye and the judgment as to the amount of food required, which brings on the sense of satiety, which prevents the early recurrence of hunger, is, naturally enough, bulk. Yet it is not bulk, but weight and appropriate chemical composition, which determine nutritive value. The result is that when bulk is especially high or low in relation to weight, or when either is due largely to substances edible but not nutritious, the uncritical consumer is likely to vary his allowance widely, without being aware of the fact. To take an illustration

from breakfast cereals: In an ordinary two or three course meal, most persons would perhaps agree that an ounce and a half of any dry, granular, ready-to-serve breakfast food (two or three generous tablespoonfuls) would constitute a reasonable portion; whereas in the case of a dry flaked cereal, the same weight would go far towards filling a pint measure; could hardly be served in the bowl which would be suitable for most cereals, without refilling; and would probably be rejected by most persons as being an unduly large portion; indeed, half that weight would be a more acceptable serving to most. The discrepancy in food value between two such servings of these foods is, then, more than 100 per cent.

Again: In the case of cooked breakfast foods, we have a similar contrast with the more concentrated cereal served in its dry granular form; although the serving of mush or porridge may weigh from three to five ounces or more, most of that weight is due to water taken up in the cooking, and the amount of dry cereal represented in a serving is perhaps from one half to three quarters of an ounce.

The appraisal of food values on page 566 for two apparently similar breakfast menus illustrates again the influence of accessories (cream, butter, sugar) upon food values, as they help to double both protein and fuel figures for the second breakfast. It is to be noted that hot muffins usually "take more butter" than does toast, and toast more than does cold bread. Here is also illustrated the contrast in food value between a watery (cooked) and a concentrated cereal; a contrast still further enhanced by the fact that these cooked cereals are usually eaten with a smaller amount of cream than are the dry ones. Again, the psychology of serving is interesting; many persons who "could not possibly eat two eggs for breakfast" when the boundary line between eggs is plainly to be discerned, will nevertheless find a one-egg serving of scrambled egg rather too small; so that many housewives prefer to allow an extra egg or two in making the family dish. Serving a chicken presents similar problems; two two-and-one-half-pound chickens carved at the table may "go further" than one five-pound chicken, not because they furnish more meat (very probably they actually furnish less) but because they furnish a greater number of cuts which can be served.

But since this "natural instinct" or "normal appetite for food" has brought the human species thus far and safely through the long records of history and biology, why should any one now contemplate its abandonment, even for a moment?

To answer this question, let us consider these four propositions:

1. The preservation and improvement of the human species as a whole, and of its individuals, has come to depend upon very different factors from those which governed its welfare when the laws of this

BREAKFAST I

	Weight in Oz.	Protein, Grams	Calories[2]
Cantaloupe (with rind, 16.4 oz.) without rind	6.6	1.4	93
Corn or wheat porridge (uncooked, ½ oz.), about	4.44	1.54	51
Cream, 25 per cent. fat	1.43	1.08	100
Sugar	0.50		57
	6.37	2.62	208
Toast, 3 slices (thin; bread untoasted, 1.48 oz.)	1.10	3.90	109
Butter, 1 pat	0.50	0.14	109
	1.6	4.04	218
Egg, poached, 1	1.57	5.90	65
Butter, 1 teaspoonful, about	0.25	0.07	54
	1.82	5.97	119
Coffee, ⅜ pint	6.35		
Cream, 25 per cent. fat, 1½ tablespoonfuls, about	1.00	0.76	70
Sugar, 3 level teaspoonfuls or 2 small lumps	0.50		56
	7.85	0.76	126
Total breakfast	24.24	14.79	764

BREAKFAST II

Sliced peaches	5.00	0.98	57
Cream, 25 per cent. fat	2.00	1.52	140
Sugar	1.00		113
	8.00	2.50	310
Wheat grits of some kind, ready-to-serve	1.50	4.81	156
Cream, 25 per cent. fat	2.50	1.90	175
Sugar	0.50		57
	4.5	6.71	388
Muffins, 2	3.0	8.25	275
Butter, 1½ pats	0.75	0.21	163
	3.75	8.46	438
Scrambled egg:			
Eggs, 1½ per serving	2.36	8.85	98
Milk, 1½ tablespoonfuls, about	1.25	1.16	24
Butter, 1 teaspoonful	0.25	0.07	54
(Cooked weight 3.56 oz.)	3.86	10.08	176
Coffee as above	7.85	0.76	126
Total breakfast	27.96	28.51	1,438

2 These calorie values have been obtained by the use of Atwater or Sherman factors, chosen to allow for average losses of food not digested. These factors are, 4 calories per gram for proteins and carbohydrates, 9 for fats.

inherited instinct were evolved. The "survival of the fittest" involves the extermination of what we may charitably denominate "the others." But the nobler elements of modern human sentiment demand the protection, not to say the cherishing, of the unfit; who thus survive and hand on their legacy of ill adjustment to another generation. Furthermore, in these days of the supremacy of certain qualities of gray matter, such as shrewdness and "business faculty," and of human tools, the industrial (non-human) machines, it is far from being the case that the man who is muscularly fittest has the best immediate chance of survival, even if we leave all the works of human altruism out of consideration. By various means is the inevitable punishment for physical degeneration greatly delayed; and so vital a matter as a lack of adjustment of fuel or building material to body requirement, in spite of its ultimately more or less serious consequences, may go long with little remark. For instance, where in the "state of nature" does one find an over-fat animal? The struggle is too keen, to permit such to survive. Yet the over-fat human is by no means an uncommon phenomenon.

2. Furthermore, the fact that serious and rather common errors in nutrition are considered by physicians as important contributing causes to diseases which usually develop in middle life, and which result in long morbidity of insidious development lacking in the spectacular element produced by sudden mortality—this fact of the long delay of punishment tends to obscure the nature of the error. It is true, however, that having accomplished something toward the conquest of bubonic plague and cholera, typhoid and even tuberculosis, we are beginning to ask ourselves why it is that certain diseases are so constantly on the increase. For answer (in part, at least), it is more and more frequently mentioned to us, that overfeeding, that is, feeding too much protein, or too much fuel, or both, is often a predisposing factor of some importance in such cases as these: kidney and gall-bladder infections and inflammations, certain kinds of disturbance of the circulatory system (*e. g.*, arteriosclerosis, high blood-pressure diseases), various infections of skin or mucous membranes (from a common cold to the most serious eczema cases), and even possibly cancer.[3]

3. The voluntary muscles, which in the activities of the human animal in a "state of nature," use probably 75 per cent. of the fuel

[3] The author does not wish to be understood as making the claim that these diseases—*e. g.*, gall-stones, Bright's disease, diabetes, etc.—always, or often, have overeating as a sole or chief cause, even though it is so frequently mentioned as one of the causes. It must be remembered, too, that most points regarding the relation of diets to disease are still more or less in the controversial stage. Moreover, it must not be forgotten that the dangers of under-nutrition (especially in persons under 30 years of age) are equally serious with those of overeating.

which the body requires, have in this last century had their activities suppressed and curtailed as never before; this is true not only in sedentary (business or professional) but also in large sections of the industrial classes. We should expect, then, that the traditions, customs, and "instincts" of the frontiersman, the hard-working peasant, the soldier, who use from 4,000 to 6,000 calories' worth a day when they can get it, and need it all, may not necessarily prove a wise guide in the matter of food consumption, for their descendants, the bookkeeper, the broker, the skilled artisan, the factory hand, whose requirements are 2,500 to 3,000 calories a day. Hunger may be diminished by lessening muscular work, but appetite is not necessarily so; indeed, it seems that nerve-poisoning and heightened irritability resulting from overstrain and unhygienic indoor living may sometimes unduly heighten (instead of interfering with) the appetite for food; this is also the case with the other appetites, sensibilities and cravings of a "nervous" person, in many instances.

4. The changed condition of food materials due to the excessive utilization of high concentrates and to the use of artificial flavorings, has already been discussed; as has also the inadequacy of an inherited instinct satisfied by bulk in the stomach, for limiting the amounts of these concentrates which should be eaten.

The discrepancies, then, which are so frequently to be observed, between food requirement and food consumption, may be explained as due in part to present lack of adjustment to recent and enormous changes in environment and human activities and in the nature of foods. It seems quite possible that adaptation of diet to the activities of the organism, and other important hygienic measures, may come about, not simply through the slowly accomplished downfall of degenerate classes and nations, which history has so often shown us—for neither the rich fruits of shrewd business capacity nor the activities of the altruistic can ultimately shelter physical deterioration—but through the further discovery of the principles of scientific management of the human organism, and through the apprehension of these by the enlightened classes and the consequent practise of them by the world's population. Should we, indeed, expect the scientific intelligence to accomplish so much less striking results in the study of the structure and conduct of our own machine, than in that of the simpler non-living machines? Is it reasonable to assume that the laws of scientific feeding which man has already begun to apply with some success to other animals, will fail to produce results with the human species itself?